TREATABILITY STUDIES AND TREATABILITY STUDIES REPORTS

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Treatability studies are performed as necessary and appropriate for the waste materials and evaluation of treatment options. If any treatability studies are performed, the report should be completed and submitted, even if the recommendation is not to use the process. Contracting for treatability studies is difficult and inappropriate before the contaminants and contaminated media are identified and quantified. It is a good idea to include an option for treatability studies in most predesign scopes. Treatability studies are not always required.

See the EPA "Guidance for Conducting Treatability Studies Under CERCLA," EPA/540/R-92/071a October 1992 for general guidelines.

The process engineer (either an environmental engineer with process design experience or a chemical engineer with design experience), the geologist (if the treatability study would be testing the withdrawal of ground water or soil vapor), the geotechnical engineer (if the contaminated media is soil), and the chemist need to be involved in development of the scope of any treatability study.
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1. Identifying Sources for Results of Previous Treatability Studies on Similar Materials
   1.1 Literature Search/Expert Judgment

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Reports and Documents
Guidance for Conducting Remedial Investigations and Feasibility Studies
Superfund Treatability Clearinghouse Abstracts
The Superfund Innovative Technology Evaluation Program: Technology Profiles
Summary of Treatment Technology Effectiveness for Contaminated Soil
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1.2 Electronic Data Bases

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Alternative Treatment Technology Information Center (ATTIC)
Computerized On-Line Information System (COLIS)
OSWER Electronic Bulletin Board System (BBS)
RREL Treatability Data Base
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1.3 EPA Personnel Consultations through EPA RPM

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Robert S. Kerr Environmental Research Laboratory Ground-Water Fate and Transport Technical Support Center at Ada, OK
Risk Reduction Engineering Laboratory Engineering Technical Support Center Cincinnati, OH
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2. Treatability Study Workplan Outline

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The treatability study workplan should be submitted and approved before initiation of the sampling for treatability studies. Chemists, geologists, geotechnical engineers, industrial hygienists, process design engineers, and regulatory personnel should review the workplan for a treatability study. This plan would be considered an attachment to the project workplan and would not, to the extent practical, reiterate information presented in the project workplan.
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2.1 Background

2.1.1 Project Description

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This should be presented in the project workplan unless the treatability study is scoped separately. Refer to the RI/FS outline, section 2.1.
****

2.1.2 Remedial Technology Description and Process Flow Diagrams

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Consider the consequences if the sequence of unit process is rearranged. Consider the ultimate disposal requirements of all phases and all side streams. Cross media transfer without

neutralization of the toxicity is discouraged by the National Contingency Plan.
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2.1.3 Previous Results with Similar Influent Materials

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List references and describe the limitations of similarity.
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2.2 Treatability Test Objectives

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Refer to section 1 of the RI/FS outline for the appropriate approach to determining objectives. Also refer to section 2.1 of the RI/FS for information on scoping Contractor involvement in developing objectives. See Enclosure 11, Alternative Development and Selection.
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2.2.1 Remedy Screening - Qualitative
2.2.2 Remedy Selection - Quantitative
2.2.3 Establishing Data Quality Objectives (DQOs) - Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC)
2.3 Approach
2.4 Reporting Requirements
2.5 Schedule and Level of Effort
2.5.1 Schedule

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The draft treatability study should be submitted for review and comment before disassembly of the equipment. Bench scale tests should be performed before the ROD is prepared.

Bench scale test: laboratory validation of treatment processes. Tests are normally batch or equilibrium adaptations of the steady state processes. Tests may be performed on actual or simulated waste material. Spiking of actual waste or simulation is frequently necessary to test for worst conditions.

Screening tests should be performed early in the alternative development process. There are some new, quick and inexpensive, methods and facilities available for preliminary screening at EPA RREL in Cincinnati. If these EPA facilities

are considered, RREL may have an SOP that is adequate for the scope. Ask for a copy and review it to see if it meets the needs of the project.

Other batch tests should be performed after the site has been characterized, late in the RI or early in the FS, for appropriate sample selection.

Analyses for interferences are easily performed in the batch mode. Most divalent metal ions interfere with continuous operation of oxidation processes and air stripping. Accuracy of plus or minus 0.05 ppm is appropriate for the prevalent cations and hardness.

Pilot tests are demonstration tests that simulate a process closely enough to determine design parameters for full scale unit operations. A pilot test is normally conducted on actual waste material, although some spiking is used to determine capacity or to simulate worst anticipated field conditions. Pilot tests often attempt to simulate worst conditions. Pilot studies may be performed to determine equipment capacity and range of operation parameters (i.e. concentration, temperature, contact, residence, or detention time) required to obtain the performance objectives.
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2.5.2 Level of Effort

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Remedy screening
Study scale: bench
Data generated: qualitative
Process type: batch
Waste stream volume: small
Number of replicates: single/duplicate
Time required: days
Cost range: $10,000-$50,000

Remedy selection
Study scale: bench-full
Data generated: quantitative
Process type: batch or continuous
Waste stream volume: medium to large
Number of replicates: duplicate/triplicate
Time required: days/months
Cost range: $50,000-$250,000
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2.5.3 Budget
2.6 Experimental Design and Procedures

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Treatability studies should be designed to obtain the data that is needed to assess the effectiveness of a specific process in remediation.
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2.6.1 Experimental Design
2.6.2 Detailed Outline of the Procedures

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The treatability study workplan should include step-by-step detail of the procedures to be used in performing the treatability study.
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2.6.2.1 Methods
2.6.2.2 Procedures
2.6.2.3 Sample Material Handling
2.6.2.4 Treated Material Handling
2.6.2.5 Process Residuals Handling
2.7 Equipment and Materials

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Equipment and instrumentation to be used in the treatability study should be completely identified.)
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2.7.1 Equipment
2.7.2 On-line Monitors
2.7.3 Other Instrumentation.

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Field type instrumentation is satisfactory for most pilot scale work with full laboratory data quality management implemented only on selected samples before and after treatment. The workplan should indicate the instrumentation to be used.

Measure parameters that affect field implementation; ultimate disposal; mechanical stability of residual solids; effects of freeze thaw cycles; dust generation; water absorption or loss pH and pH changes; temperature and temperature changes; heat loss; heat gain
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2.8 Chemical Data Acquisition Plan/Sampling and Analysis Plan (SAP)

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This does not replace the RI/FS sampling requirements, it merely cites special considerations for treatability studies. This plan will essentially incorporate the elements of the EPA's Field Sampling Plan, Quality Assurance Project Plan, and Data Management Plan. Depending on the nature of the field activities needed for the treatability study, a Monitoring Well installation and Drilling Plan may be required.

The handling of gross samples should be as similar as possible to the handling of the analytical samples. See Enclosure 13: Chemistry Technical Requirements.

As an option, the sample collection section and the sample analysis and validation sections can be broken out as separate tasks. Given the limited nature of the sampling in many studies and the important role chemical analysis may have in treatability studies, they are discussed under the treatability study task.

The chemist should consult with the process engineer to determine what analytical parameters are to be monitored during the treatment process. Analytical levels II, III, IV, or V may apply to these studies. Data reporting format and turnaround time may need to be specified in this section, depending upon users needs.

Field samples may not represent the predicted worst case. Analyze portions of the samples before shipment to the treatability study laboratory. At a minimum, treatability testing should be performed under worst case conditions and under typical or average conditions. It may be necessary to provide supplemental contaminants.

Volume estimates on the amount to be treated should be provided or a cross reference to the appropriate part of the treatability study plan be provided.

Field sample waste streams for characterization and testing, conduct treatability tests, analyze samples of treated materials and residuals

The SOW should have the Contractor estimate the projected volume of material to be treated to determine equipment capacity.

For appropriate sample selection, pilot tests should be performed after overall site characterization (QA/QC documentation need not be complete), concurrent with alternative selection and ROD development, before initiation of design.

Final Treatability Study Reports may be submitted concurrently with the RI/FS or separately.

For Quality Assurance issues, coordinate with and refer to the project workplan quality assurance section. Quality assurance needed for remedy screening is the least stringent; for remedy selection, moderately stringent QA is appropriate.

For data analysis and data interpretation, see Enclosure 11: Alternative Development and Selection for a discussion of alternatives.
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2.9 Site Safety and Health Plan/ Health and Safety Plan

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The site safety and health plan for the RI characterization activities may cover all of the types of activities required. Append new procedures to the existing plan.
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2.10 Residuals Management and Compliance with the Regulatory Requirements

2.10.1 Residuals Management

2.10.1.1 On Site

2.10.1.2 Off Site

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The regulatory specialist must confirm that off-site lab facility to run treatability tests is permitted or plans to operate under the RCRA treatability exclusions in 40 CFR 261.4 (e) and (f). If the treatability exclusion is to be used, state regulations must be considered and the CFR must be carefully read to minimize adverse impacts on the project. Some impacts can be handled through scoping.
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2.11 Community Relations

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The community relations plan for the pilot study must be in concert with the project community relations plan. Remedy screening: low profile/few activities
Remedy selection of f site: generally not controversial and low profile/few activities

An onsite remedy selection may be controversial and high profile/significant activities
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2.12 Management and Staffing
2.13 Outline for the Treatability Study Report

3. Treatability Study Report Format Outline
- 3.1 Introduction
  - 3.1.1 Site Description
  - 3.1.2 Waste Stream Description
  - 3.1.3 Treatment Technology Description
  - 3.1.4 Previous Treatability Studies at the Site
- 3.2 Conclusions and Recommendations
  - 3.2.1 Conclusions
  - 3.2.2 Recommendations
- 3.3 Treatability Study Approach
  - 3.3.1 Test Objectives and Rationale
  - 3.3.2 Experimental Design and Procedures
    - 3.3.2.1 Design
    - 3.3.2.2 Procedures
    - 3.3.2.3 Discussion of any Variations from the Work plan.
  - 3.3.3 Equipment and Materials
  - 3.3.4 sampling and Analysis
    - 3.3.4.1 Analyses or Reference to the Appropriate Report.
    - 3.3.4.2 A/QC Report or Reference to the Appropriate Report.
  - 3.3.5 Data Management
  - 3.3.6 Derivatives from the Work plan
- 3.4. Results and Discussion
  - 3.4.1 Data Analysis and Interpretation
  - 3.4.2 Quality Assurance/Quality Control
  - 3.4.3 Identification of additional testing needs
  - 3.4.4 Cost/Schedules for Performing the Treatability Study
  - 3.4.5 Key Contacts

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All Superfund/N.L. treatability reports are submitted to the RREL Treatability Data Base Repository, organized by the EPA Office of Research and Development.
Attn: Mr. Glenn Schaul
REEL Treatability Data Base
U.S. EPA ORD Risk Reduction Engineering Laboratory
26 West Martin Luther King Drive
Cincinnati, OH 45268
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3.4.6 References
3.4.7 Standard Operating Procedures
3.4.8 Data Summaries
3.4.9 All Side Notations from Laboratory Books

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These notes may have significant value
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4. Appendices to the Treatability Study
- 4.1 Sample Calculations Showing
  - 4.1.1 Use of generated Data
  - 4.1.2 Identification of all Variables
    - 4.1.2.1 Measured
      - 4.1.2.1.1 Range of Experimentally Determined Values for the Variables.
      - 4.1.2.1.2 Sensitivity to variation.
    - 4.1.2.2 Calculated
    - 4.1.2.3 Assumed
    - 4.1.2.2 Unknown
- 4.2 Process Flow Diagrams
  - 4.2.1 Flow Diagram
  - 4.2.2 Material Balance Showing Average Values
- 4.3 Summary of the Data
- 4.4 Scale-up Considerations
  - 4.4.1 Performance
  - 4.4.2 Operation and Maintenance
- 4.5 Identification of the Limits of the Process as Indicated by the Results

5. Specific Process Recommendations
- 5.1 Air Stripping

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General water quality parameters and tower scaling

parameters, etc., should be evaluated.
- pH
- hardness
- cations
- alkalinity

Bench scale tests typically do not yield useful data for design of full scale stripping systems. More useful data can be obtained from literature searches and packing manufacturers' technical data sheets.
Pilot scale tests are generally not necessary. Adequate data is available.
Design should maximize effluent VOC concentration in the exhaust gas to lower off gas treatment cost.
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5.2 Biological Treatment

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Pilot work should consider variations in the site.
Ensure that analyses cover all required parameters.
Monitor VOC emissions.

"Guide for Conducting Treatability Studies under CERCLA: Aerobic Biodegradation Remedy Screening" published by EPA REEL in Cincinnati is a good resource document. It is not a stand alone set of instructions for all biological treatment studies.

Consider the effects of pre-treatment, particularly on pH.
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5.3 Carbon Adsorption

5.3.1 Vapor Phase

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Ideal gas behavior is approximated, but data on removals to reach the low levels to meet ambient air standards is not generally available and is difficult to measure under dynamic conditions. Vapors from vapor extraction sites are normally saturated or super saturated. Of f gas from strippers is near saturation. If the humidity is not reduced, the water vapor condenses in the adsorber and consumes carbon capacity.
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5.3.2 Liquid Phase

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Isotherms do not simulate steady state conditions. Dynamic testing is required to evaluate the required time of contact to reach the requirement limit. It is difficult to achieve breakthrough in mini columns.
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5.4 Dechlorination/Soil Washing

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Dechlorination affects the soil structure. Structural stability characteristics of the treated material are critical to final placement.
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5.5 Solidification/Stabilization

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Solidification/stabilization treatability study scopes are covered by a separate ETL.
Considerations:
- Physical properties
- Materials handling characteristics
- Generic mix design.
- Proprietary additives.

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5.6 Thermal Desorption/Incineration

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CEWES has a low temperature pilot unit and will perform treatability studies. Obtain a copy of the WES protocol to get an understanding of how they will do the study and what the report will be like. The Contractor and the design district process engineer both need to understand what WES will do and if the information will be adequate for design.
If there are any Contractor requested changes to the WES protocol the district process engineer should be involved in the changes.

"Guide for Conducting Treatability Studies under CERCLA: Thermal Desorption Remedy Selection" is being prepared by EPA contract.

Obtain an adequate and representative sample. The Contractor should be responsible for sample collection,

packaging and shipping to WES if WES does the study.

Characterize/analyze a sample of the sample prior to shipment
Consider parameters that affect VOC removal rates.
- Undisturbed moisture content of sample
- BTU content of sample
- Temperature
- Air and/or oxygen flow
- Residence time
- Time and temperature curves
- Consider problems
  - Slag formation
  - Partitioning of the metals: Keep track of where the metals are.

Materials handling: Soil characterization including liquid limit, plastic limit, etc.

If the feed material contains significant amounts of heavy metals, produce enough ash for solidification/stabilization tests while the incineration test is going. Provide adequate material for the unit to achieve steady state before measurements are made to determine the operating parameters. Enough samples to represent the entire site should be processed.
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5.7 Soil Vapor Extraction

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Additional criteria are under development.
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5.8 Floating Product Recovery

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Additional criteria are under development.
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5.9 Catalyzed Oxidation

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Additional criteria are under development.
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5.10 Adsorption and Ion Exchange

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Additional criteria are under development.
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5.11 Emerging Technologies

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Additional criteria are under development.
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5.12 Solvent Extraction

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"Guidance for conducting Treatability Studies Under CERCLA: Solvent Extraction Remedy Selection" is being prepared under EPA contract.
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5.13 Other Treatment Processes

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Additional criteria are under development.
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